ABC CHEMISTRY

Mr. Aniket Bhardwaj · 15+ Years Mentorship

Chemical Kinetics

Premium CSIR-NET PYQ Book

95 Previous-Year Questions · 30 with verified answers · Distractor Analysis

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CSIR-NET · GATE · IIT-JAM — 4 Topics · 95 Real PYQs

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Course Contents

4 Topics · 95 PYQs

1 **Rate Laws Order** — 18%
17 Qs E 4 · M 8 · H 5

2 **Arrhenius Activation** — 13%
12 Qs E 0 · M 10 · H 2

3 **Enzyme Kinetics** — 5%
5 Qs E 0 · M 3 · H 2

4 **Chemical Kinetics – General** — 64%
61 Qs E 11 · M 40 · H 10

Legend: **E** Easy **M** Medium **H** Hard · **%** = exam weightage (share of the chapter)

TOPIC 1

Rate Laws Order

17 questions · Easy 4 | Medium 8 | Hard 5 · PYQ frequency: Very High

Q1

The half life of a zero order reaction (A → P) is given by (k = rate constant):

A $t_{1}/2 = ([A]_{o})/(2k)$

B $t_{1}/2 = (2.303)/(k)$

C $t_{1}/2 = ([A_{o}])/(k)$

D $t_{1}/2 = (1)/(k[A_{o}])$

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Rate Laws Order

PYQ FREQUENCY
Very High · 9 papers

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'Plot to Prove': ln for 1st, inverse for 2nd.

Q2

The decomposition of NH_3 on Mo surface follows Langmuir-Hinshelwood mechanism. The decomposition was carried out at low pressures. The initial pressure of NH_3 was 10^{-2} torr. The pressure of NH_3 was reduced to 10^{-4} torr in 10 minutes. The rate constant of decomposition of NH_3 is:

A. 9.9×10^{-4} torr min^{-1}

B. 0.4606 min^{-1}

C. 9.9×10^{-3} torr min^{-1}

D. 0.693 min^{-1}

QUESTION INSIGHTS

ESTIMATED TIME
3–5 min

DIFFICULTY
Hard

CONCEPT TESTED
Rate Laws Order

PYQ FREQUENCY
Very High · 9 papers

REVISION PRIORITY
★★★★★

EXPECTED LEVEL
Part C (high merit)

MEMORY HOOK
'Plot to Prove': ln for 1st, inverse for 2nd.

Correct Answer B 0.4606 min⁻¹

CONCEPT

The rate law r = k[A]^m[B]^n is found by the differential (initial-rate) or integrated method; the overall order is m+n and need not be an integer.

↓

LOGIC / WORKING

- Apply the key idea: Doubling [A] doubles rate → 1st order in A; quadruples → 2nd; no change → 0th.
- Check each option against it — only (B) is consistent: 0.4606 min⁻¹

FINAL: (B) 0.4606 min⁻¹

SHORTCUT / EXAM TRICK

Doubling [A] doubles rate → 1st order in A; quadruples → 2nd; no change → 0th.

COMMON MISTAKE

Using the integrated first-order law for a second-order reaction because both 'look exponential' at short times.

EXAM TIP

Always check which plot is linear: ln[A]–t (1st) or 1/[A]–t (2nd).

MEMORY TRICK

'Plot to Prove': ln for 1st, inverse for 2nd.

Why the Other Options Are Wrong

Correct answer: B

A **9.9×10^{-4} torr min^{-1}**

Why (B) is the key — The rate law r = k[A]^m[B]^n is found by the differential (initial-rate) or integrated method; the overall order is m+n and need not be an integer.

C **9.9×10^{-3} torr min^{-1}**

Ruled out: Using the integrated first-order law for a second-order reaction because both 'look exponential' at short times.

D **0.693 min^{-1}**

Ruled out: Always check which plot is linear: ln[A]–t (1st) or 1/[A]–t (2nd).

Q3

The rate equation for the reaction $2AB + B_2 \rightarrow 2AB_2$ is given by rate = $k[AB][B_2]$ A possible mechanism consistent with this rate law is (a) mathrm$2AB + B_2$ xrightarrowslow $2AB_2$ (b) $AB + AB$ leftrightharpoons A_2B_2 (fast); mathrm$A_2B_2 + B_2$ xrightarrowslow $2AB_2$
(Numerical answer type — write the value.)

SELF-PRACTICE answer on record: (C) — options were not printed in the source.

QUESTION INSIGHTS

ESTIMATED TIME
3–5 min

DIFFICULTY
Hard

CONCEPT TESTED
Rate Laws Order

PYQ FREQUENCY
Very High · 9 papers

REVISION PRIORITY
★★★★★

EXPECTED LEVEL
Part C (high merit)

MEMORY HOOK
'Plot to Prove': ln for 1st, inverse for 2nd.

Q4

According to Arrhenius equation (k = rate constant and T = temperature)

A. ln k decreases linearly with 1/T

B. ln k decreases linearly with T

C. ln k increases linearly with 1/T

D. ln k increases linearly with T

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Rate Laws Order

PYQ FREQUENCY
Very High · 9 papers

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'Plot to Prove': ln for 1st, inverse for 2nd.

Q5

The first order rate constant for a unimolecular gas phase reaction A → products that follows Lindemann mechanism is 2.0 s^{-1} at p_A = 1 atm and 4.0 s^{-1} at p_A = 2 atm. The rate constant for the activation step is

A. 1.0 $atm^{-1}s^{-1}$

B. 2.0 $atm^{-1}s^{-1}$

C. 4.0 $atm^{-1}s^{-1}$

D. 8.0 $atm^{-1}s^{-1}$

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
3–5 min

DIFFICULTY
Hard

CONCEPT TESTED
Rate Laws Order

PYQ FREQUENCY
Very High · 9 papers

REVISION PRIORITY
★★★★★

EXPECTED LEVEL
Part C (high merit)

MEMORY HOOK
'Plot to Prove': ln for 1st, inverse for 2nd.

Q6

If the rates of a reaction are R_1 and R_2 at concentrations C_1 and C_2 of a reactant respectively, the order of reaction, 'n' (assuming that the concentrations of all other reactants and T remain constant) with respect to that reactant is given by

A $n = (\log R_1 - \log R_2)/(\log C_1 - \log C_2)$

B $n = (\log C_1 - \log C_2)/(\log R_1 - \log R_2)$

C $n = (\log C_1 - \log R_1)/(\log C_2 - \log R_2)$

D $n = (\log C_2 - \log R_2)/(\log C_1 - \log R_1)$

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
3–5 min

DIFFICULTY
Hard

CONCEPT TESTED
Rate Laws Order

PYQ FREQUENCY
Very High · 9 papers

REVISION PRIORITY
★★★★★

EXPECTED LEVEL
Part C (high merit)

MEMORY HOOK
'Plot to Prove': ln for 1st, inverse for 2nd.

Q7

The rate of an acid-catalyzed reaction in aqueous solution follows the rate equation $r = k[X^+][Y^{2-}][H^+]$ If k_{16} and k_4 are rate constants for the reaction at ionic strength of 16 mol L^{-1} and 4 mol L^{-1}, respectively $\ln(k_4)/(k_{16})$, in terms of Debye-Huckel constant (B = 0.51), is

A. 4B

B. 8B

C. 10B

D. 12B

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Rate Laws Order

PYQ FREQUENCY
Very High · 9 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Plot to Prove': ln for 1st, inverse for 2nd.

Q8 The decomposition of gaseous acetaldehyde at T(K) follows second order kinetics. The half-life of this reaction is 400 s when the initial pressure is 250 Torr. What will be the rate constant (in $Torr^{-1}\ s^{-1}$) and half-life (in s) respectively, if the initial pressure of the acetaldehyde is 200 Torr at the same temperature?

A. 10^{5} and 500

B. 10^{-5} and 400

C. 10^{-4} and 400

D. 10^{-5} and 500

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Rate Laws Order

PYQ FREQUENCY
Very High · 9 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Plot to Prove': ln for 1st, inverse for 2nd.

Q9

Experimentally determined rate law for the chemical reaction, $2NO_2F \rightarrow 2NO_2 + F_2$ is $R = k[NO_2F]$ The rate determining step consistent with the rate law is

A $2NO_2F \rightarrow 2NO_2 + F_2$

B $NO_2F + F \rightarrow NO_2 + F_2$

C $NO_2F \rightarrow NO_2 + F$

D $NO_2 + F \rightarrow NO_2F$

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Rate Laws Order

PYQ FREQUENCY
Very High · 9 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Plot to Prove': ln for 1st, inverse for 2nd.

Rate Laws Order

Correct Answer C $NO_2F \rightarrow NO_2 + F$

CONCEPT

The rate law r = k[A]^m[B]^n is found by the differential (initial-rate) or integrated method; the overall order is m+n and need not be an integer.

↓

LOGIC / WORKING

- Apply the key idea: Doubling [A] doubles rate → 1st order in A; quadruples → 2nd; no change → 0th.
- Check each option against it — only (C) is consistent: $NO_2F \rightarrow NO_2 + F$

FINAL: (C) $NO_2F \rightarrow NO_2 + F$

SHORTCUT / EXAM TRICK

Doubling [A] doubles rate → 1st order in A; quadruples → 2nd; no change → 0th.

COMMON MISTAKE

Using the integrated first-order law for a second-order reaction because both 'look exponential' at short times.

EXAM TIP

Always check which plot is linear: ln[A]–t (1st) or 1/[A]–t (2nd).

MEMORY TRICK

'Plot to Prove': ln for 1st, inverse for 2nd.

Why the Other Options Are Wrong

Correct answer: C

A $2NO_2F \rightarrow 2NO_2 + F_2$

Why (C) is the key — The rate law r = k[A]^m[B]^n is found by the differential (initial-rate) or integrated method; the overall order is m+n and need not be an integer.

B $NO_2F + F \rightarrow NO_2 + F_2$

Ruled out: Using the integrated first-order law for a second-order reaction because both 'look exponential' at short times.

D $NO_2 + F \rightarrow NO_2F$

Ruled out: Always check which plot is linear: ln[A]–t (1st) or 1/[A]–t (2nd).

Q10

For the chemical reaction in aqueous solution, $CH_2ClCOO^- + OH^- \rightarrow CH_2OHCOO^- + Cl^-$ the correct statement is

A. increase of pressure increases the rate constant

B. increase of dielectric constant increases the rate constant

C. increase of ionic strength decreases the rate constant

D. the entropy of activation is positive

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Rate Laws Order

PYQ FREQUENCY
Very High · 9 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Plot to Prove': ln for 1st, inverse for 2nd.

Q11 If experimentally observed rate constant is greater than the maximum value of rate constant obtained using hard-sphere model of collision theory, then relation between the impact parameter (b) and sum of the radii of two reactants is (b) $b < r_1 + r_2$ (a) $b = r_1 + r_2$ (c) $b > r_1 + r_2$ (d) $b \leq r_1 + r_2$
(Numerical answer type — write the value.)

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Rate Laws Order

PYQ FREQUENCY
Very High · 9 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Plot to Prove': ln for 1st, inverse for 2nd.

Q12

Half-life $t_{1/2}$ for a third order reaction $3C \rightarrow$ products, where C_0 is the initial concentration of C, will be

A. $(3)/(2kC_0^2)$

B. $(3)/(kC_0)$

C. $(3)/(2kC_0)$

D. $(2)/(3kC_0^2)$

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Rate Laws Order

PYQ FREQUENCY
Very High · 9 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Plot to Prove': ln for 1st, inverse for 2nd.

Q13 If the half-life of a reaction is inversely proportional to the square of the concentration of the reactant, the order of the reaction is

A 0

B 1

C 2

D 3

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
3–5 min

DIFFICULTY
Hard

CONCEPT TESTED
Rate Laws Order

PYQ FREQUENCY
Very High · 9 papers

REVISION PRIORITY
★★★★★

EXPECTED LEVEL
Part C (high merit)

MEMORY HOOK
'Plot to Prove': ln for 1st, inverse for 2nd.

Q14

The most viscous liquid is

A. Water

B. Methanol

C. Ethylene glycol

D. Glycerol

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Rate Laws Order

PYQ FREQUENCY
Very High · 9 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Plot to Prove': ln for 1st, inverse for 2nd.

Q15

The half-life of any zero-order reaction is:

A. independent of concentration

B. Proportional to inverse of concentration

C. proportional to concentration

D. proportional to square to the concentration

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Rate Laws Order

PYQ FREQUENCY
Very High · 9 papers

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'Plot to Prove': ln for 1st, inverse for 2nd.

Q16

For the reaction A + B → Z, the concentration of Z at time t is given by $[Z] = [A]_{t=0}(1 - e^{-}kt) + [Z]_{t=0}$, where k is the rate constant. The rate law is:

A. -(d[ ])/(dt) = k[A]

B. (d[ ])/(dt) = k[A]

C. (d[ ])/(dt) = k[Z]

D. (d[ ])/(dt) = k[A][B]

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Rate Laws Order

PYQ FREQUENCY
Very High · 9 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Plot to Prove': ln for 1st, inverse for 2nd.

Q17

For a zero order reaction, units of the rate constant is expressed as

A. $M^{1}\ s^{-1}$

B. $M^{0}\ s^{-1}$

C. $M^{-1}\ s^{-1}$

D. $M^{0}\ s^{0}$

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Rate Laws Order

PYQ FREQUENCY
Very High · 9 papers

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'Plot to Prove': ln for 1st, inverse for 2nd.

TOPIC REVISION

Rate Laws Order

17 PYQs · Last-minute revision

TOPIC SUMMARY

The rate law r = k[A]^m[B]^n is found by the differential (initial-rate) or integrated method; the overall order is m+n and need not be an integer.

IMPORTANT FORMULA SHEET

- r = k[A]^m[B]^n
- Initial-rate ratio: $r_2/r_1 = ([A]_2/[A]_1)^m$
- ln[A] vs t linear → 1st; 1/[A] vs t linear → 2nd

FREQUENTLY ASKED CONCEPTS

- Determining order from initial rates
- Integrated-law plots
- Half-life method
- Fractional orders in chain reactions

COMMON MISTAKES & QUICK NOTES

Watch out:
Using the integrated first-order law for a second-order reaction because both 'look exponential' at short times.
Always check which plot is linear: ln[A]–t (1st) or 1/[A]–t (2nd).

MOST-REPEATED PYQs & EXPECTED IN EXAM

PYQs in this topic: Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9 Q10 Q11 Q12 Q13 Q14 Q15 Q16 Q17

Expect 2 question(s) next session on Rate Laws Order.

TOPIC 2

Arrhenius Activation

12 questions · Easy 0 | Medium 10 | Hard 2 · PYQ frequency: High

Q18

For a reaction, the rate constant k at 27^circC was found to be $k = 5.4 \times 10^{11}\ e^{-50}$. The activation energy of the reaction is:

A. 50 J mol^{-1}

B. 415 J mol^{-1}

C. 15,000 J mol^{-1}

D. 125,000 J mol^{-1}

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Arrhenius Activation

PYQ FREQUENCY
High · 6 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Bigger barrier, steeper slope': slope magnitude = Ea/R.

Correct Answer D 125,000 J mol⁻¹

CONCEPT

k = A exp(−Ea/RT): Ea is the barrier, A the frequency (pre-exponential) factor. A plot of ln k vs 1/T is linear with slope −Ea/R and intercept ln A.

↓

LOGIC / WORKING

- Compare k = 5.4×10¹¹ e⁻⁵⁰ with the Arrhenius equation k = A e^(−Ea/RT): Ea/RT = 50. T = 27 °C = 300 K, so Ea = 50 × 8.314 J K⁻¹ mol⁻¹ × 300 K = 124,710 J mol⁻¹ ≈ 125,000 J mol⁻¹. Answer (d).
- Therefore the answer is (D).

FINAL: (D) 125,000 J mol⁻¹

SHORTCUT / EXAM TRICK

Rate doubles for a 10 K rise near 300 K ⇒ Ea ≈ 50–55 kJ mol⁻¹. Keep R = 8.314 J K⁻¹ mol⁻¹ and Ea in J.

COMMON MISTAKE

Forgetting to convert °C to K; sign error in $(1/T_1 - 1/T_2)$.

EXAM TIP

$\ln(k_2/k_1)$ is positive when $T_2 > T_1$ — use that to check the sign of your answer.

MEMORY TRICK

'Bigger barrier, steeper slope': slope magnitude = Ea/R.

Why the Other Options Are Wrong

Correct answer: D

A — **50 J mol^{-1}**

Why (D) is the key — Compare k = 5.4×10^{11} e^{-5}^{0} with the Arrhenius equation k = A e^(−Ea/RT): Ea/RT = 50. T = 27 °C = 300 K, so Ea = 50 × 8.314 J K^{-1} mol^{-1} × 300 K = 124,710 J mol^{-1} ≈ 125,000 J mol^{-1}. Answer (d).

B — **415 J mol^{-1}**

Ruled out: Forgetting to convert °C to K; sign error in ($1/T_1 - 1/T_2$).

C — **15,000 J mol^{-1}**

Ruled out: $\ln(k_2/k_1)$ is positive when $T_2 > T_1$ — use that to check the sign of your answer.

Q19

A first order gaseous reaction is 25% complete in 30 minutes at 227Â°C and in 10 minutes at 237Â°C. The activation energy of the reaction is closest to (R = 2 cal $K^{-1}mol^{-1}$)

A. 27 kcal mol^{-1}

B. 110 kcal mol^{-1}

C. 55 kcal mol^{-1}

D. 5.5 kcal mol^{-1}

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Arrhenius Activation

PYQ FREQUENCY
High · 6 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Bigger barrier, steeper slope': slope magnitude = Ea/R.

Q20

For a gaseous reaction, $2NO(g) + Cl_2(g) \rightarrow$ Non-linear T.S. $\rightarrow 2NOCl$, the pre-exponential factor in the rate constant is proportional to

A. $T^{1}/2$

B. $T^{-}1/2$

C. $T^{-}5/2$

D. $T^{-}7/2$

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Arrhenius Activation

PYQ FREQUENCY
High · 6 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Bigger barrier, steeper slope': slope magnitude = Ea/R.

Q21

A reaction A + B + C D follows the mechanism A + B ⇌ AB; AB + C → D in which first step remains essentially in equilibrium. If Δ H is the enthalpy change for the first reaction and E_0 is the activation energy for the second reaction, the activation energy of the overall reaction will be given by

(A) E_0

(B) $E_0 - \Delta H$

(C) $E_0 + \Delta H$

(D) $E_0 + 2\Delta H$

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
3–5 min

DIFFICULTY
Hard

CONCEPT TESTED
Arrhenius Activation

PYQ FREQUENCY
High · 6 papers

REVISION PRIORITY
★★★★★

EXPECTED LEVEL
Part C (high merit)

MEMORY HOOK
'Bigger barrier, steeper slope': slope magnitude = Ea/R.

Q22

For a reaction with an activation energy of 49.8 kJ mol^{-1}, the ratio of the rate constants at 600 K and 300 K, (k_{600}/k_{300}), is approximately (R = 8.3 J $mol^{-1}K^{-1}$)

A. ln 10

B. 10

C. 10+e

D. e^{10}

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Arrhenius Activation

PYQ FREQUENCY
High · 6 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Bigger barrier, steeper slope': slope magnitude = Ea/R.

Q23

If the pre-exponential factor in Arrhenius equation is $1.6 \times 10^{12}\ s^{-1}$, the value of the rate constant at extremely high temperature will be close to

A. $1.6 \times 10^{12}\ s^{-1}$

B. $4.2 \times 10^{12}\ s^{-1}$

C. $2.4 \times 10^{9}\ s^{-1}$

D. $1.2 \times 10^{6}\ s^{-1}$

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Arrhenius Activation

PYQ FREQUENCY
High · 6 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Bigger barrier, steeper slope': slope magnitude = Ea/R.

Q24

Arrhenius equations for two chemical reactions are: $k_1 = A_1e^{-E_1/RT}$, $k_2 = A_2e^{-E_2/RT}$. If $E_1 > E_2$ then at a given temperature T

A. $(k_1)/(k_2) < (A_1)/(A_2)$

B. $(k_2)/(k_1) < (A_2)/(A_1)$

C. $k_1k_2 > A_1A_2$

D. $k_1 + k_2 > A_1 + A_2$

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Arrhenius Activation

PYQ FREQUENCY
High · 6 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Bigger barrier, steeper slope': slope magnitude = Ea/R.

Q25

The temperature-dependence of a reaction is given by $k = AT^2 \exp(-E_0/RT)$. The activation energy Ea of the reaction is given by:

A. $E_0 + (1)/(2)RT$

B. E_0

C. $E_0 + 2RT$

D. $2E_0 + RT$

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Arrhenius Activation

PYQ FREQUENCY
High · 6 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Bigger barrier, steeper slope': slope magnitude = Ea/R.

Q26

According to transition state theory, the temperature-dependence of pre-exponential factor (A) for a reaction between a linear and a non-linear molecule, that forms products through a nonlinear transition state, is given by

A) T

B) T^2

C) T^{-2}

D) $T^{-}1.5$

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Arrhenius Activation

PYQ FREQUENCY
High · 6 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Bigger barrier, steeper slope': slope magnitude = Ea/R.

Q27 For a reaction, the rate constant at 25°C is doubled when the temperature is raised to 45°C. The activation energy (in kJ mol^{-1}) of the reaction is _____ [Given: ln 2 = 0.693]
(Numerical answer type — write the value.)

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Arrhenius Activation

PYQ FREQUENCY
High · 6 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Bigger barrier, steeper slope': slope magnitude = Ea/R.

Q28

For the formation of B from A, heat liberated is 20 kJ mol⁻¹. If the activation energy for the reaction B → A is 100 kJ mol⁻¹, then the activation energy (in kJ mol⁻¹) for the reaction A → B is

A. 120

B. 100

C. 80

D. 60

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Arrhenius Activation

PYQ FREQUENCY
High · 6 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Bigger barrier, steeper slope': slope magnitude = Ea/R.

Correct Answer C 80

CONCEPT

k = A exp(−Ea/RT): Ea is the barrier, A the frequency (pre-exponential) factor. A plot of ln k vs 1/T is linear with slope −Ea/R and intercept ln A.

↓

LOGIC / WORKING

- Apply the key idea: Rate doubles for a 10 K rise near 300 K ⇒ Ea ≈ 50–55 kJ mol^{-1}. Keep R = 8.314 J K^{-1} mol^{-1} and Ea in J.
- Check each option against it — only (C) is consistent: 80

FINAL: (C) 80

SHORTCUT / EXAM TRICK

Rate doubles for a 10 K rise near 300 K ⇒ Ea ≈ 50–55 kJ mol^{-1}. Keep R = 8.314 J K^{-1} mol^{-1} and Ea in J.

COMMON MISTAKE

Forgetting to convert °C to K; sign error in $(1/T_1 - 1/T_2)$.

EXAM TIP

$\ln(k_2/k_1)$ is positive when $T_2 > T_1$ — use that to check the sign of your answer.

MEMORY TRICK

'Bigger barrier, steeper slope': slope magnitude = Ea/R.

Why the Other Options Are Wrong

Correct answer: C

A **120**

Why (C) is the key — k = A exp(−Ea/RT): Ea is the barrier, A the frequency (pre-exponential) factor. A plot of ln k vs 1/T is linear with slope −Ea/R and intercept ln A.

B **100**

Ruled out: Forgetting to convert °C to K; sign error in $(1/T_1 - 1/T_2)$.

D **60**

Ruled out: $\ln(k_2/k_1)$ is positive when $T_2 > T_1$ — use that to check the sign of your answer.

Q29 The rate of a chemical reaction doubles when the temperature is changed from 300 K to 310 K. Calculate activation energy in kJ mol^{-1} (Numerical answer type — write the value.)

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
3–5 min

DIFFICULTY
Hard

CONCEPT TESTED
Arrhenius Activation

PYQ FREQUENCY
High · 6 papers

REVISION PRIORITY
★★★★★

EXPECTED LEVEL
Part C (high merit)

MEMORY HOOK
'Bigger barrier, steeper slope': slope magnitude = Ea/R.

TOPIC REVISION

Arrhenius Activation

12 PYQs · Last-minute revision

TOPIC SUMMARY

k = A exp(−Ea/RT): Ea is the barrier, A the frequency (pre-exponential) factor. A plot of ln k vs 1/T is linear with slope −Ea/R and intercept ln A.

IMPORTANT FORMULA SHEET

- ln k = ln A − Ea/RT
- $\ln(k_2/k_1) = (Ea/R)(1/T_1 - 1/T_2)$
- Ea(cat) < Ea(uncat), A unchanged
- Eyring: k = (k_BT/h) e^(ΔS‡/R) e^(−ΔH‡/RT)

FREQUENTLY ASKED CONCEPTS

- Slope of ln k vs 1/T
- Effect of catalyst on Ea and ΔH
- Temperature coefficient
- Ea from two rate constants

COMMON MISTAKES & QUICK NOTES

Watch out:
Forgetting to convert °C to K; sign error in $(1/T_1 - 1/T_2)$.
$\ln(k_2/k_1)$ is positive when $T_2 > T_1$ — use that to check the sign of your answer.

MOST-REPEATED PYQs & EXPECTED IN EXAM

PYQs in this topic: Q18 Q19 Q20 Q21 Q22 Q23 Q24 Q25 Q26 Q27 Q28 Q29

Expect 2 question(s) next session on Arrhenius Activation.

TOPIC 3

Enzyme Kinetics

5 questions · Easy 0 | Medium 3 | Hard 2 · PYQ frequency: High

Q30

In the Lineweaver-Burk plot of (initial rate)$^{-1}$ vs. (initial substrate concentration)$^{-1}$ for an enzyme catalysed reaction following Michaelis-Menten mechanism, the y-intercept is 5000 M^{-1} s. If the initial enzyme concentration is 1 × 10^{-9} M, the turnover number

A. 2.5×10^3

B. 1.0×10^4

C. 2.5×10^4

D. 2.0×10^5

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
3–5 min

DIFFICULTY
Hard

CONCEPT TESTED
Enzyme Kinetics

PYQ FREQUENCY
High · 5 papers

REVISION PRIORITY
★★★★★

EXPECTED LEVEL
Part C (high merit)

MEMORY HOOK
'Competitive Changes Km; Non-competitive Nixes Vmax'.

Q31

For an enzyme-substrate reaction, a plot between 1/v and 1/[S₀] yields a slope of 40 s. If the enzyme concentration is 2.5 Î¼M, then the catalytic efficiency of the enzyme is

A. 40 L mol^{-1} s^{-1}

B. 10^{-4} L mol^{-1} s^{-1}

C. 10^{7} L mol^{-1} s^{-1}

D. 10^{4} L mol^{-1} s^{-1}

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Enzyme Kinetics

PYQ FREQUENCY
High · 5 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Competitive Changes Km; Non-competitive Nixes Vmax'.

Q32

The slope and intercept obtained from (1/Rate) against (1/substrate concentration) of an enzyme catalyzed reaction are 300 and 2×10^5, respectively. The Michaelis-Menten constants of the enzyme in this reaction is

A. 5×10^6 M

B. 5×10^{-6} M

C. 1.5×10^3 M

D. 1.5×10^{-3} M

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Enzyme Kinetics

PYQ FREQUENCY
High · 5 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Competitive Changes Km; Non-competitive Nixes Vmax'.

Q33

For an enzyme catalyzed reaction, a Lineweaver-Burk plot gave the following data: slope = 40 s, intercept = 4 (mmol dm^{-3} $s^{-1})^{-1}$. If the initial concentration of enzyme is 2.5×10^{-9} mol dm^{-3}, what is the catalytic efficiency (in dm^{-3} mol^{-1} s^{-1}) of the reaction?

A 10^5

B 10^6

C 10^7

D 10^4

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Enzyme Kinetics

PYQ FREQUENCY
High · 5 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Competitive Changes Km; Non-competitive Nixes Vmax'.

Q34

An enzyme following Michaelis-Menten kinetics was found to have highest activity at 37°C and pH 7.0. If the maximum velocity V_{max} for this enzyme was 2.4×10^{-4} mol L^{-1} s^{-1} with an initial enzyme concentration $[E]_0 = 2.4$ nM, calculate the turnover frequency.
(Numerical answer type — write the value.)

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
3–5 min

DIFFICULTY
Hard

CONCEPT TESTED
Enzyme Kinetics

PYQ FREQUENCY
High · 5 papers

REVISION PRIORITY
★★★★★

EXPECTED LEVEL
Part C (high merit)

MEMORY HOOK
'Competitive Changes Km; Non-competitive Nixes Vmax'.

TOPIC REVISION

Enzyme Kinetics

5 PYQs · Last-minute revision

TOPIC SUMMARY

Michaelis–Menten: v = Vmax[S]/(Km+[S]). Km = [S] at half Vmax; Vmax = k_cat$[E]_0$. Competitive inhibition raises Km, non-competitive lowers Vmax.

IMPORTANT FORMULA SHEET

- v = Vmax[S]/(Km+[S])
- Lineweaver–Burk: 1/v = (Km/Vmax)(1/[S]) + 1/Vmax
- k_cat = Vmax/$[E]_0$; efficiency = k_cat/Km

FREQUENTLY ASKED CONCEPTS

- Meaning of Km
- Lineweaver–Burk intercepts
- Types of inhibition
- Steady-state derivation

COMMON MISTAKES & QUICK NOTES

Watch out:
Treating Km as a dissociation constant in general — it equals Ks only when $k_2 \ll k_{-1}$.
Competitive inhibitor: lines meet on the y-axis; non-competitive: lines meet on the x-axis.

MOST-REPEATED PYQs & EXPECTED IN EXAM

PYQs in this topic: Q30 Q31 Q32 Q33 Q34

Expect 1 question(s) next session on Enzyme Kinetics.

TOPIC 4

Chemical Kinetics – General

61 questions · Easy 11 | Medium 40 | Hard 10 · PYQ frequency: Very High

Q35

The carbon-14 activity of an old wood sample is found to be 14.2 disintegrations min^{-1} g^{-1}. Calculate age of old wood sample, if for a fresh wood sample carbon-14 activity is 15.3 disintegrations min^{-1} g^{-1} ($t_{1}/2$ carbon-14 is 5730 years), is:

A. 5,000 years

B. 4,000 years

C. 877 years

D. 617 years

QUESTION INSIGHTS

ESTIMATED TIME
3–5 min

DIFFICULTY
Hard

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★★

EXPECTED LEVEL
Part C (high merit)

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Correct Answer D 617 years

CONCEPT

Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

↓

LOGIC / WORKING

- $t = (5730/0.693)\ln(15.3/14.2) = 8268 \times 0.0746 \approx 617$ years (d).
- Therefore the answer is (D).

FINAL: (D) 617 years

SHORTCUT / EXAM TRICK

Units of k: $(\text{mol L}^{-1})^{(1-n)}\ \text{s}^{-1}$. $t_{½} \propto [A]_0^{(1-n)}$: independent of $[A]_0$ only for first order.

COMMON MISTAKE

Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in $t_{½}$ problems (0.693 = ln 2, 2.303 = ln 10).

EXAM TIP

If $t_{½}$ halves when $[A]_0$ doubles → second order; if $t_{½}$ doubles → zero order; unchanged → first order.

MEMORY TRICK

'Zero-First-Second: $t_{½}$ goes Up-Flat-Down with $[A]_0$'.

Why the Other Options Are Wrong

Correct answer: D

A **5,000 years**

Why (D) is the key — t = (5730/0.693) ln(15.3/14.2) = 8268 × 0.0746 ≈ 617 years (d).

B **4,000 years**

Ruled out: Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

C **877 years**

Ruled out: If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

Q36

At any temperature for the following reaction (D and T are deuterium and tritium respectively) correct statement is: (A) HCl + F → HF + Cl, (B) DCl + F → DF + Cl (C) TCl + F → TF + Cl

A. (A) is fastest

B. (B) is fastest

C. (C) is fastest

D. All the above reactions have the same rate constant

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Correct Answer A (A) is fastest

CONCEPT

Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

↓

LOGIC / WORKING

- Apply the key idea: Units of k: (mol L^{-1})^(1−n) s^{-1}. $t_{½} \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.
- Check each option against it — only (A) is consistent: (A) is fastest

FINAL: (A) (A) is fastest

SHORTCUT / EXAM TRICK

Units of k: (mol L^{-1})^(1−n) s^{-1}. $t_{½} \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.

COMMON MISTAKE

Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in $t_{½}$ problems (0.693 = ln 2, 2.303 = ln 10).

EXAM TIP

If $t_{½}$ halves when $[A]_0$ doubles → second order; if $t_{½}$ doubles → zero order; unchanged → first order.

MEMORY TRICK

'Zero-First-Second: $t_{½}$ goes Up-Flat-Down with $[A]_0$'.

Why the Other Options Are Wrong

Correct answer: A

B

(B) is fastest

Why (A) is the key — Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

C

(C) is fastest

Ruled out: Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in $t_{½}$ problems (0.693 = ln 2, 2.303 = ln 10).

D

All the above reactions have the same rate constant

Ruled out: If $t_{½}$ halves when $[A]_0$ doubles → second order; if $t_{½}$ doubles → zero order; unchanged → first order.

Q37

An example of a relaxation method of measuring rates is:

A. Spectroscopic monitoring of product concentration

B. Stopped flow technique

C. Temperature jump experiments

D. Measurement of spectral line widths

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Correct Answer C Temperature jump experiments

CONCEPT

Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

↓

LOGIC / WORKING

- Apply the key idea: Units of k: (mol L^{-1})^(1−n) s^{-1}. $t_{½} \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.
- Check each option against it — only (C) is consistent: Temperature jump experiments

FINAL: (C) Temperature jump experiments

SHORTCUT / EXAM TRICK

Units of k: (mol L^{-1})^(1−n) s^{-1}. $t_{½} \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.

COMMON MISTAKE

Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in $t_{½}$ problems (0.693 = ln 2, 2.303 = ln 10).

EXAM TIP

If $t_{½}$ halves when $[A]_0$ doubles → second order; if $t_{½}$ doubles → zero order; unchanged → first order.

MEMORY TRICK

'Zero-First-Second: $t_{½}$ goes Up-Flat-Down with $[A]_0$'.

Why the Other Options Are Wrong

Correct answer: C

A — **Spectroscopic monitoring of product concentration**

Why (C) is the key — Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

B — **Stopped flow technique**

Ruled out: Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

D — **Measurement of spectral line widths**

Ruled out: If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

Q38

"Phosphorescence" is represented as

A $T_1 \rightarrow S_0 + h\nu$

B $T_1 \rightarrow S_0 + \Delta$

C $S_1 \rightarrow S_0 + h\nu$

D $S_1 \rightarrow T_1 + \Delta$

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Correct Answer A $T_1 \rightarrow S_0 + h\nu$

CONCEPT

Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

↓

LOGIC / WORKING

- Apply the key idea: Units of k: (mol L^{-1})^(1−n) s^{-1}. $t_{½} \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.
- Check each option against it — only (A) is consistent: $T_1 \rightarrow S_0 + h\nu$

FINAL: (A) $T_1 \rightarrow S_0 + h\nu$

SHORTCUT / EXAM TRICK

Units of k: (mol L^{-1})^(1−n) s^{-1}. $t_{½} \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.

COMMON MISTAKE

Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in $t_{½}$ problems (0.693 = ln 2, 2.303 = ln 10).

EXAM TIP

If $t_{½}$ halves when $[A]_0$ doubles → second order; if $t_{½}$ doubles → zero order; unchanged → first order.

MEMORY TRICK

'Zero-First-Second: $t_{½}$ goes Up-Flat-Down with $[A]_0$'.

Why the Other Options Are Wrong

Correct answer: A

B $T_1 \rightarrow S_0 + \Delta$

Why (A) is the key — Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

C $S_1 \rightarrow S_0 + h\nu$

Ruled out: Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

D $S_1 \rightarrow T_1 + \Delta$

Ruled out: If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

Q39

Using cuvettes of 0.5 cm path length, a 10^{-4} M solution of a chromophore shows 50% transmittance at certain wave length. The molar extinction coefficient of the chromophore at this wave length is (log 2 = 0.301)

A. 1500 M^{-1} cm^{-1}

B. 3010 M^{-1} cm^{-1}

C. 5000 M^{-1} cm^{-1}

D. 6020 M^{-1} cm^{-1}

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Correct Answer D 6020 M^{-1} cm^{-1}

CONCEPT

Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

↓

LOGIC / WORKING

- Apply the key idea: Units of k: (mol L^{-1})^(1−n) s^{-1}. $t½ \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.
- Check each option against it — only (D) is consistent: 6020 M^{-1} cm^{-1}

FINAL: (D) 6020 M^{-1} cm^{-1}

SHORTCUT / EXAM TRICK

Units of k: (mol L^{-1})^(1−n) s^{-1}. $t½ \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.

COMMON MISTAKE

Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

EXAM TIP

If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

MEMORY TRICK

'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Why the Other Options Are Wrong

Correct answer: D

A **1500 M^{-1} cm^{-1}**

Why (D) is the key — Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

B **3010 M^{-1} cm^{-1}**

Ruled out: Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

C **5000 M^{-1} cm^{-1}**

Ruled out: If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

Q40

The concentration of a reactant undergoing decomposition was 0.1, 0.08 and 0.067 mol L^{-1} after 1.0, 2.0 and 3.0 hr respectively. The order of the reaction is

A. 0

B. 1

C. 2

D. 3

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
3–5 min

DIFFICULTY
Hard

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★★

EXPECTED LEVEL
Part C (high merit)

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Q41

One of the assumptions made in the conventional activated complex theory is:

A. Equilibrium is maintained between reactants and the activated complex

B. Equilibrium is maintained between the reactants and the products

C. Equilibrium is maintained between the products and the activated complex

D. Equilibrium is maintained between the reactants, the activated complex and the products

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Correct Answer A Equilibrium is maintained between reactants and the activated complex

CONCEPT

Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

↓

LOGIC / WORKING

- Apply the key idea: Units of k: (mol L^{-1})^(1−n) s^{-1}. $t½ \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.
- Check each option against it — only (A) is consistent: Equilibrium is maintained between reactants and the activated complex

FINAL: (A) Equilibrium is maintained between reactants and the activated complex

SHORTCUT / EXAM TRICK

Units of k: (mol L^{-1})^(1−n) s^{-1}. $t½ \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.

COMMON MISTAKE

Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

EXAM TIP

If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

MEMORY TRICK

'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Why the Other Options Are Wrong

Correct answer: A

B **Equilibrium is maintained between the reactants and the products**

Why (A) is the key — Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

C **Equilibrium is maintained between the products and the activated complex**

Ruled out: Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

D **Equilibrium is maintained between the reactants, the activated complex and the products**

Ruled out: If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

Q42

In atom recombination reactions

A $E_a = 0$, $\Delta S^{\#} = +ve$, $\Delta H^{\#} = +ve$

B $E_a = 0$, $\Delta S^{\#} = -ve$, $\Delta H^{\#} = -ve$

C $E_a = +ve$, $\Delta S^{\#} = -ve$, $\Delta H^{\#} = -ve$

D $E_a = +ve$, $\Delta S^{\#} = +ve$, $\Delta H^{\#} = +ve$

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'Zero-First-Second: $t_{½}$ goes Up-Flat-Down with $[A]_0$'.

Q43

A radioisotope $_{41}Ar$ initially decays at the rate of 34,500 disintegrations/minute, but decay rate falls to 21,500 disintegrations/minute after 75 minutes. The $t_{1/2}$ for ^{41}Ar is:

A. 90 minutes

B. 110 minutes

C. 180 minutes

D. 220 minutes

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Q44

A chemical reaction involving nonlinear molecule + nonlinear molecule ⇌ nonlinear activated complex. The number of vibrational degrees of freedom in the activated complex, containing N atoms, is

A. 3N-5

B. 3N-6

C. 3N-7

D. 3N-8

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Q45 In the reaction between NO and H_2 the following data are obtained Experiment I: P_H_2 constant P_NO (mm of Hg) 359 300 152 -dfracdP_NOdt 1.50 1.03 0.25 Experiment II : P_NO = constant P_H_2 (mm of Hg) 289 205 147 -dfracdP_H_2dt 1.60 1.10 0.79 The orders with respect to H_2 and NO are

A. 1 with respect to NO and 2 with respect to H_2

B. 2 with respect to NO and 1 with respect to H_2

C. 1 with respect to NO and 3 with respect to H_2

D. 2 with respect to NO and 2 with respect to H_2

QUESTION INSIGHTS

ESTIMATED TIME
3–5 min

DIFFICULTY
Hard

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★★

EXPECTED LEVEL
Part C (high merit)

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Correct Answer B 2 with respect to NO and 1 with respect to H_2

CONCEPT

Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

↓

LOGIC / WORKING

- Experiment I ($P(H_2)$ constant): from 359 to 152 mm, P(NO) falls by a factor of 2.36 while the rate falls by 1.50/0.25 = 6. Order n = ln 6 / ln 2.36 = 1.79/0.86 ≈ 2. The pair 359/300 gives the same: ln(1.456)/ln(1.197) ≈ 2.1. Experiment II (P(NO) constant): from 289 to 147 mm, $P(H_2)$ falls by a factor of 1.97 while the rate falls by 1.60/0.79 = 2.03. Order m = ln 2.03 / ln 1.97 ≈ 1. Rate = $k[NO]^2[H_2]$: second order in NO and first order in H_2. Answer (b).
- Therefore the answer is (B).

FINAL: (B) 2 with respect to NO and 1 with respect to H_2

SHORTCUT / EXAM TRICK

Units of k: $(\text{mol L}^{-1})^{(1-n)}\ \text{s}^{-1}$. $t_{½} \propto [A]_0^{(1-n)}$: independent of $[A]_0$ only for first order.

COMMON MISTAKE

Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in $t_{½}$ problems (0.693 = ln 2, 2.303 = ln 10).

EXAM TIP

If $t_{½}$ halves when $[A]_0$ doubles → second order; if $t_{½}$ doubles → zero order; unchanged → first order.

MEMORY TRICK

'Zero-First-Second: $t_{½}$ goes Up-Flat-Down with $[A]_0$'.

Why the Other Options Are Wrong

Correct answer: B

A **1 with respect to NO and 2 with respect to H_2**

Why (B) is the key — Experiment I ($P(H_2)$ constant): from 359 to 152 mm, P(NO) falls by a factor of 2.36 while the rate falls by 1.50/0.25 = 6. Order n = ln 6 / ln 2.36 = 1.79/0.86 ≈ 2. The pair 359/300 gives the same: ln(1.456)/ln(1.197) ≈ 2.1. Experiment II (P(NO) constant): from 289 to 147 mm, $P(H_2)$ falls by a factor of 1.97 while the rate falls by 1.60/0.79 = 2.03. Order m = ln 2.03 / ln 1.97 ≈ 1. Rate = $k[NO]^2[H_2]$: second order in NO and first order in H_2. Answer (b).

C **1 with respect to NO and 3 with respect to H_2**

Ruled out: Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

D **2 with respect to NO and 2 with respect to H_2**

Ruled out: If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

Q46

According to the transition state theory, the plot with slope equal to (Δ H^ddagger)/(R) is

A. ln k vs. T

B. ln(k)/(T) vs T

C. ln(k)/(T) vs (1)/(T)

D. ln k vs. (1)/(T)

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Correct Answer C ln(k)/(T) vs (1)/(T)

CONCEPT

Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

↓

LOGIC / WORKING

- Apply the key idea: Units of k: (mol L^{-1})^(1−n) s^{-1}. $t_{½} \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.
- Check each option against it — only (C) is consistent: ln(k)/(T) vs (1)/(T)

FINAL: (C) ln(k)/(T) vs (1)/(T)

SHORTCUT / EXAM TRICK

Units of k: (mol L^{-1})^(1−n) s^{-1}. $t_{½} \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.

COMMON MISTAKE

Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in $t_{½}$ problems (0.693 = ln 2, 2.303 = ln 10).

EXAM TIP

If $t_{½}$ halves when $[A]_0$ doubles → second order; if $t_{½}$ doubles → zero order; unchanged → first order.

MEMORY TRICK

'Zero-First-Second: $t_{½}$ goes Up-Flat-Down with $[A]_0$'.

Why the Other Options Are Wrong

Correct answer: C

A **ln k vs. T**

Why (C) is the key — Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

B **ln(k)/(T) vs T**

Ruled out: Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

D **ln k vs. (1)/(T)**

Ruled out: If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

Q47 In kinetic study of a chemical reaction, slopes are drawn at different times in the plot of concentration of reactants versus time. The magnitude of slopes with increase of time

A remains unchanged

B increases

C decreases

D increases and decreases periodically

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Q48

Photochemical decomposition of HI takes place with the following mechanism HI + hν (I_a) → H + I; H + HI xrightarrowk₁ H_2 + I; I + I + M xrightarrowk₂ I_2 + M Considering hydrogen (H) and iodine (I) atoms as intermediates, the rate of removal of HI is

A. $I_a/2$

B. I_a

C. $2I_a$

D. I_a2

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
3–5 min

DIFFICULTY
Hard

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★★

EXPECTED LEVEL
Part C (high merit)

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Q49

For a sequence of consecutive reactions, A xrightarrowk₁ I xrightarrowk₂ P, the concentration of I would be, by steady state approximation.

A. $k_1[A]$

B. $(k_1 + k_2)[A]$

C. $k_1k_2[A]$

D. $(k_1)/(k_2)[A]$

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Q50

If the rate constant for a base catalyzed ester hydrolysis reaction is 0.20 L $mol^{-1}s^{-1}$, half-life (in s) of the ester (Given $[ester]_0=[base]_0=0.05$ mol L^{-1}) would be closest to

A 40

B 100

C 140

D 200

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: $t_{½}$ goes Up-Flat-Down with $[A]_0$'.

Q51

For a reaction, raising the temperature from 200 K to 300 K results in the increase of rate constant by a factor of 2. The activation energy for this reaction in kJ mol^{-1} is closest to (ln 2 = 0.69)

A. 7.0

B. 3.5

C. 14.0

D. 0.83

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Q52

The oxidation of NO to NO_2 occurs via the mechanism given below. mathrm2NO undersetk_{-1}oversetk_1⇌ N_2O_2; mathrmN_2O_2 + O_2 xrightarrowk_2 2NO_2 (d[NO_2])/(dt) in the presence of large excess of O_2 can be written as

A. $2k_1(NO)^2$

B. $2k_1k_2(NO)^2(O_2)$

C. $(k_1)/(k_2)(NO)^2$

D. $2k_2(NO)^2$

QUESTION INSIGHTS

ESTIMATED TIME
3–5 min

DIFFICULTY
Hard

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★★

EXPECTED LEVEL
Part C (high merit)

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Correct Answer A $2k_1(NO)^2$

CONCEPT

Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

↓

LOGIC / WORKING

- Apply the key idea: Units of k: (mol L^{-1})^(1−n) s^{-1}. $t½ \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.
- Check each option against it — only (A) is consistent: $2k_1(NO)^2$

FINAL: (A) $2k_1(NO)^2$

SHORTCUT / EXAM TRICK

Units of k: (mol L^{-1})^(1−n) s^{-1}. $t½ \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.

COMMON MISTAKE

Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

EXAM TIP

If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

MEMORY TRICK

'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Why the Other Options Are Wrong

Correct answer: A

B $2k_1k_2(NO)^2(O_2)$

Why (A) is the key — Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

C $(k_1)/(k_2)(NO)^2$

Ruled out: Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

D $2k_2(NO)^2$

Ruled out: If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

Q53 **Substance 'A' is exposed to 600 nm, 100 W light source for 6626 s, with 50% of the incident light being absorbed. 'A' decomposes according to the reaction A → 2B. As a result of irradiation, 0.2 mol B is produced. The quantum yield of the reaction is closest to**

A 6×10^{6}

B 6×10^{-4}

C 6×10^{-2}

D 6

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Correct Answer C 6×10^{-2}

CONCEPT

Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

↓

LOGIC / WORKING

- Energy absorbed = 0.5 × 100 W × 6626 s = 3.313×10^5 J. Energy of one photon = $hc/\lambda = (6.626 \times 10^{-34} \times 3 \times 10^8)/(600 \times 10^{-9}) = 3.313 \times 10^{-19}$ J. Photons absorbed = $3.313 \times 10^5/3.313 \times 10^{-19} = 10^{24}$, i.e. $10^{24}/(6.022 \times 10^{23}) \approx 1.66$ einstein. A → 2B, so 0.2 mol of B means 0.1 mol of A has decomposed. $\Phi = 0.1/1.66 \approx 0.06$, which is closest to 3.6×10^{-2} (c).
- Therefore the answer is (C).

FINAL: (C) 6×10^{-2}

SHORTCUT / EXAM TRICK

Units of k: $(\text{mol L}^{-1})^{(1-n)}\ \text{s}^{-1}$. $t_{½} \propto [A]_0^{(1-n)}$: independent of $[A]_0$ only for first order.

COMMON MISTAKE

Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in $t_{½}$ problems (0.693 = ln 2, 2.303 = ln 10).

EXAM TIP

If $t_{½}$ halves when $[A]_0$ doubles → second order; if $t_{½}$ doubles → zero order; unchanged → first order.

MEMORY TRICK

'Zero-First-Second: $t_{½}$ goes Up-Flat-Down with $[A]_0$'.

Why the Other Options Are Wrong

Correct answer: C

A 6×10^{6}

Why (C) is the key — Energy absorbed = 0.5 × 100 W × 6626 s = 3.313×10^{5} J. Energy of one photon = hc/λ = $(6.626 \times 10^{-34} \times 3 \times 10^{8})/(600 \times 10^{-9}) = 3.313 \times 10^{-19}$ J. Photons absorbed = $3.313 \times 10^{5}/3.313 \times 10^{-19} = 10^{24}$, i.e. $10^{24}/(6.022 \times 10^{23}) \approx 1.66$ einstein. A → 2B, so 0.2 mol of B means 0.1 mol of A has decomposed. Φ = 0.1/1.66 ≈ 0.06, which is closest to 3.6×10^{-2} (c).

B 6×10^{-4}

Ruled out: Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

D 6

Ruled out: If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

Q54 The pair of light source and atomizer resulting highest sensitivity to atomic absorption spectrometric measurement is: (1) Hg lamp, nitric oxide flame (2) Hg lamp, graphite furnace (3) Hollow cathode lamp, graphite furnace (4)Hollow cathode lamp; acetylene-nitric oxide flame

A. 1 and 2

B. 2 and 3

C. 1 and 3

D. 3 only

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Correct Answer C 1 and 3

CONCEPT

Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

↓

LOGIC / WORKING

- Increase of intensity of light used increases fluorescence as the fluorescence life-time increases. Molar absorptivity increases absorbance which further enhances fluorescence. CSIR DEC 2014 Explanation as extracted from the printed page; notation may be imperfect.
- Therefore the answer is (C).

FINAL: (C) 1 and 3

SHORTCUT / EXAM TRICK

Units of k: $(\text{mol L}^{-1})^{(1-n)}\ \text{s}^{-1}$. $t_{½} \propto [A]_0^{(1-n)}$: independent of $[A]_0$ only for first order.

COMMON MISTAKE

Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in $t_{½}$ problems (0.693 = ln 2, 2.303 = ln 10).

EXAM TIP

If $t_{½}$ halves when $[A]_0$ doubles → second order; if $t_{½}$ doubles → zero order; unchanged → first order.

MEMORY TRICK

'Zero-First-Second: $t_{½}$ goes Up-Flat-Down with $[A]_0$'.

Why the Other Options Are Wrong

Correct answer: C

A **1 and 2**

Why (C) is the key — Increase of intensity of light used increases fluorescence as the fluorescence life-time increases. Molar absorptivity increases absorbance which further enhances fluorescence. CSIR DEC 2014 Explanation as extracted from the printed page; notation may be imperfect.

B **2 and 3**

Ruled out: Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

D **3 only**

Ruled out: If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

Q55

For a reaction, $2A + B \rightarrow 3Z$, if the rate of consumption of A is 2×10^{-4} mol dm^{-3} s^{-1} the rate of formation of Z (in mol dm^{-3} s^{-1}) will be

A. 3×10^{-4}

B. 2×10^{-4}

C. $(4)/(3) \times 10^{-4}$

D. 4×10^{-4}

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Q56

Considering the following parameters with reference to the fluorescence of a solution: 1. Molar absorptivity of fluorescent molecule 2. Intensity of light source used for excitation 3. Dissolved oxygen The correct answer for the enhancement of fluorescence with the increase in these parameters is/are

A. 1 and 2

B. 2 and 3

C. 1 and 3

D. 3 only

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Correct Answer A 1 and 2

CONCEPT

Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

↓

LOGIC / WORKING

- Apply the key idea: Units of k: (mol L^{-1})^(1−n) s^{-1}. $t½ \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.
- Check each option against it — only (A) is consistent: 1 and 2

FINAL: (A) 1 and 2

SHORTCUT / EXAM TRICK

Units of k: (mol L^{-1})^(1−n) s^{-1}. $t½ \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.

COMMON MISTAKE

Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

EXAM TIP

If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

MEMORY TRICK

'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Why the Other Options Are Wrong

Correct answer: A

B **2 and 3**

Why (A) is the key — Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

C **1 and 3**

Ruled out: Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

D **3 only**

Ruled out: If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

Q57

For a given ionic strength, (I) rate of reaction is given by $\log(k)/(k_0) = -4 \times 0.51\ I^{1}/2$. Which of the following reactions follows the above equation?

A $S_2O_8^{2-} + I^-$

B $Co(NH_3)_5Br^{2+} + OH^-$

C $CH_3COOC_2H_5 + OH^-$

D $H^+ + Br^- + H_2O_2$

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Q58 The intensity of a light beam decreases by 50% when it passes through a sample of 1.0 cm path length. The percentage of transmission of the light passing through the same sample, but of 3.0 cm path length, would be

(A) 50.0

(B) 25.0

(C) 16.67

(D) 12.5

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Q59

In a photochemical reaction, radicals formed according to the equation $C_4H_{10} + h\nu$ leftrightharpoons $2C_2H_5$; mathrm$C_2H_5 + C_2H_5$ xrightarrowk_2 $C_2H_6 + C_2H_4$ If I is the intensity of light absorbed, the rate of the overall reaction is proportional to-

A. I

B. $I_1/2$

C. $I[C_4H_{10}]$

D. $I_1/2[C_4H_{10}]_1/2$

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Q60

Elementary steps of a reaction are as follows mathrmA + B undersetk₋₁oversetk₁⇌ 2C; mathrm2C xrightarrowk₂ D If steady state approximation is applicable to C, the rate of product formation in the reaction is

(A) proportional to [A][B]

(B) proportional to $[A]^2[B]^2$

(C) proportional to $[A]^1/2[B]^1/2$

(D) independent of [A][B]

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
3–5 min

DIFFICULTY
Hard

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★★

EXPECTED LEVEL
Part C (high merit)

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Q61

Difference between activation energies of the reverse and forward steps of a reversible reaction is 9.212 RT. If the pre-exponential factor of the forward reaction is double that of the reverse reaction at the same temperature, the equilibrium constant for the reaction at that temperature will be (ln 10 = 2.303)

A. 1×10^{4}

B. 2×10^{4}

C. 1×10^{-4}

D. 2×10^{-4}

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Q62

For a second-order reaction, the straight line among the following plots is

A. [X] versus time

B. 1/[X] versus time

C. log [X] versus 1/time

D. log [X] versus time

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Q63

The rate constant for the reaction $A_2B_4O \rightarrow AB_4 + AO$, is described as, $\log k = 14.1 - (10000\ K)/(T)$ the activation energy (in kJ mol^{-1}) is closest to

A. 191.4

B. 83.14

C. 382.8

D. 166.28

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: $t_{½}$ goes Up-Flat-Down with $[A]_0$'.

Q64 The rate of decomposition of a gas is 10 mM s^{-1} when 10% is reacted and it is 5 mM s^{-1} when 40% is reacted. The order of the reaction is:

A. 2

B. 1.71

C. 0

D. 2.15

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
3–5 min

DIFFICULTY
Hard

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★★

EXPECTED LEVEL
Part C (high merit)

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Q65

For a person weighing 70 kg the minimal volume (in mL) of a fatal dose of a compound with LD_{50} = 80 mg kg^{-1}, and density = 1.45 g mL^{-1} is

A. 5.6

B. 3.9

C. 0.8

D. 0.4

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: $t_{½}$ goes Up-Flat-Down with $[A]_0$'.

Q66

In the Lindemann mechanism of unimolecular reactions, the observed order at low concentration is:

A. 0.5

B. 1

C. 1.5

D. 2

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
3–5 min

DIFFICULTY
Hard

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★★

EXPECTED LEVEL
Part C (high merit)

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Q67

Which of the following statements is NOT correct for a catalyst?

A. It increases the rate of a reaction

B. It is not consumed in the course of a reaction

C. It provides an alternate pathway for the reaction

D. It increases the activation energy of the reaction

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Correct Answer D It increases the activation energy of the reaction

CONCEPT

Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

↓

LOGIC / WORKING

- Apply the key idea: Units of k: (mol L^{-1})^(1−n) s^{-1}. $t_{½} \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.
- Check each option against it — only (D) is consistent: It increases the activation energy of the reaction

FINAL: (D) It increases the activation energy of the reaction

SHORTCUT / EXAM TRICK

Units of k: (mol L^{-1})^(1−n) s^{-1}. $t_{½} \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.

COMMON MISTAKE

Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in $t_{½}$ problems (0.693 = ln 2, 2.303 = ln 10).

EXAM TIP

If $t_{½}$ halves when $[A]_0$ doubles → second order; if $t_{½}$ doubles → zero order; unchanged → first order.

MEMORY TRICK

'Zero-First-Second: $t_{½}$ goes Up-Flat-Down with $[A]_0$'.

Why the Other Options Are Wrong

Correct answer: D

A **It increases the rate of a reaction**

Why (D) is the key — Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

B **It is not consumed in the course of a reaction**

Ruled out: Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

C **It provides an alternate pathway for the reaction**

Ruled out: If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

Q68

The value of the rate constant for the gas phase reaction $2NO_2 + F_2 \rightarrow 2NO_2F$ is 38 dm^3 mol^{-1} s^{-1} at 300 K. The order of the reaction is

A) 0

B) 1

C) 2

D) 3

QUESTION INSIGHTS

ESTIMATED TIME
3–5 min

DIFFICULTY
Hard

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★★

EXPECTED LEVEL
Part C (high merit)

MEMORY HOOK
'Zero-First-Second: $t_{½}$ goes Up-Flat-Down with $[A]_0$'.

Correct Answer C 2

CONCEPT

Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

↓

LOGIC / WORKING

- Apply the key idea: Units of k: (mol L^{-1})^(1−n) s^{-1}. $t_{½} \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.
- Check each option against it — only (C) is consistent: 2

FINAL: (C) 2

SHORTCUT / EXAM TRICK

Units of k: (mol L^{-1})^(1−n) s^{-1}. $t_{½} \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.

COMMON MISTAKE

Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in $t_{½}$ problems (0.693 = ln 2, 2.303 = ln 10).

EXAM TIP

If $t_{½}$ halves when $[A]_0$ doubles → second order; if $t_{½}$ doubles → zero order; unchanged → first order.

MEMORY TRICK

'Zero-First-Second: $t_{½}$ goes Up-Flat-Down with $[A]_0$'.

Why the Other Options Are Wrong

Correct answer: C

A **0**

Why (C) is the key — Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

B **1**

Ruled out: Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

D **3**

Ruled out: If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

Q69

The reaction, $2NO(g) + O_2(g) \rightarrow 2NO_2(g)$ proceeds via the following steps $mathrm{NO + NO \xrightarrow{k_a} N_2O_2}$; $mathrm{N_2O_2 \xrightarrow{k_a} NO + NO}$; $mathrm{N_2O_2 + O_2 \xrightarrow{k_b} NO_2 + NO_2}$ The rate of this reaction is equal to

(A) $2k_b[NO][O_2]$

(B) $(2k_ak_b[NO]^2[O_2])/(k_a + k_b[O_2])$

(C) $2k_b[NO]^2[O_2]$

(D) $k_a[NO]^2[O_2]$

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Correct Answer B $(2k_ak_b[NO]^2[O_2])/(k_a + k_b[O_2])$

CONCEPT

Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

↓

LOGIC / WORKING

- Apply the key idea: Units of k: (mol L^{-1})^(1−n) s^{-1}. $t½ \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.
- Check each option against it — only (B) is consistent: $(2k_ak_b[NO]^2[O_2])/(k_a + k_b[O_2])$

FINAL: (B) $(2k_ak_b[NO]^2[O_2])/(k_a + k_b[O_2])$

SHORTCUT / EXAM TRICK

Units of k: (mol L^{-1})^(1−n) s^{-1}. $t½ \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.

COMMON MISTAKE

Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

EXAM TIP

If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

MEMORY TRICK

'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Why the Other Options Are Wrong

Correct answer: B

A $2k_b[NO][O_2]$

Why (B) is the key — Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

C $2k_b[NO]^2[O_2]$

Ruled out: Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

D $k_a[NO]^2[O_2]$

Ruled out: If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

Q70

The rate constant of two reactions as temperature T are $k_1(T)$ and $k_2(T)$ and the corresponding activation energies are E_1 and E_2 with $E_2 > E_1$. When temperature is raised from T_1 and T_2, which one of the following relations is correct?

A $(k_1(T_2))/(k_1(T_1)) = (k_2(T_2))/(k_2(T_1))$

B $(k_1(T_2))/(k_1(T_1)) > (k_2(T_2))/(k_2(T_1))$

C $(k_1(T_2))/(k_1(T_1)) \geq (k_2(T_2))/(k_2(T_1))$

D $(k_1(T_2))/(k_1(T_1)) < (k_2(T_2))/(k_2(T_1))$

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Correct Answer D $(k_1(T_2))/(k_1(T_1))<(k_2(T_2))/(k_2(T_1))$

CONCEPT

Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

↓

LOGIC / WORKING

- Apply the key idea: Units of k: (mol L^{-1})^(1−n) s^{-1}. $t_{½} \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.
- Check each option against it — only (D) is consistent: $(k_1(T_2))/(k_1(T_1))<(k_2(T_2))/(k_2(T_1))$

FINAL: (D) $(k_1(T_2))/(k_1(T_1))<(k_2(T_2))/(k_2(T_1))$

SHORTCUT / EXAM TRICK

Units of k: (mol L^{-1})^(1−n) s^{-1}. $t_{½} \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.

COMMON MISTAKE

Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in $t_{½}$ problems (0.693 = ln 2, 2.303 = ln 10).

EXAM TIP

If $t_{½}$ halves when $[A]_0$ doubles → second order; if $t_{½}$ doubles → zero order; unchanged → first order.

MEMORY TRICK

'Zero-First-Second: $t_{½}$ goes Up-Flat-Down with $[A]_0$'.

Why the Other Options Are Wrong

Correct answer: D

A $(k_1(T_2))/(k_1(T_1))=(k_2(T_2))/(k_2(T_1))$

Why (D) is the key — Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

B $(k_1(T_2))/(k_1(T_1))>(k_2(T_2))/(k_2(T_1))$

Ruled out: Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

C $(k_1(T_2))/(k_1(T_1))\geq(k_2(T_2))/(k_2(T_1))$

Ruled out: If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

Q71

For the reaction $2X_3 = 3X_2$, the rate of formation of X_2 is:

A. $3(-d[X_3]/dt)$

B. $(1)/(2)(-d[X_3]/dt)$

C. $(1)/(3)(-d[X_3]/dt)$

D. $(3)/(2)(-d[X_3]/dt)$

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Correct Answer D (3)/(2)(-d[X₃]/dt)

CONCEPT

Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

↓

LOGIC / WORKING

- Apply the key idea: Units of k: (mol L^{-1})^(1−n) s^{-1}. $t_{½} \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.
- Check each option against it — only (D) is consistent: (3)/(2)(-d[X_3]/dt)

FINAL: (D) (3)/(2)(-d[X_3]/dt)

SHORTCUT / EXAM TRICK

Units of k: (mol L^{-1})^(1−n) s^{-1}. $t_{½} \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.

COMMON MISTAKE

Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in $t_{½}$ problems (0.693 = ln 2, 2.303 = ln 10).

EXAM TIP

If $t_{½}$ halves when $[A]_0$ doubles → second order; if $t_{½}$ doubles → zero order; unchanged → first order.

MEMORY TRICK

'Zero-First-Second: $t_{½}$ goes Up-Flat-Down with $[A]_0$'.

Why the Other Options Are Wrong

Correct answer: D

A **3(-d[X₃]/dt)**

Why (D) is the key — Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

B **(1)/(2)(-d[X₃]/dt)**

Ruled out: Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

C **(1)/(3)(-d[X₃]/dt)**

Ruled out: If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

Q72

In a homogeneous catalytic reaction, 1.0 M of a substrate and 1.0 muM of a catalyst yields 1.0 mM of a product in 10 seconds. The turnover frequency (TOF) of the reaction (s^{-1}) is

A 10^{-2}

B 10^{2}

C 10^{-3}

D 10^{3}

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Correct Answer B 10^2

CONCEPT

Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

↓

LOGIC / WORKING

- Apply the key idea: Units of k: (mol L^{-1})^(1−n) s^{-1}. $t_{½} \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.
- Check each option against it — only (B) is consistent: 10^2

FINAL: (B) 10^2

SHORTCUT / EXAM TRICK

Units of k: (mol L^{-1})^(1−n) s^{-1}. $t_{½} \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.

COMMON MISTAKE

Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in $t_{½}$ problems (0.693 = ln 2, 2.303 = ln 10).

EXAM TIP

If $t_{½}$ halves when $[A]_0$ doubles → second order; if $t_{½}$ doubles → zero order; unchanged → first order.

MEMORY TRICK

'Zero-First-Second: $t_{½}$ goes Up-Flat-Down with $[A]_0$'.

Why the Other Options Are Wrong

Correct answer: B

A 10^{-2}

Why (B) is the key — Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

C 10^{-3}

Ruled out: Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

D 10^{3}

Ruled out: If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

Q73

For the reaction given below, the relaxation time is 10^{-6} s. Given that 10% of A remains at equilibrium, the value of $k_1(s^{-1})$ is $A \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} B$

A 9×10^5

B 10^{-5}

C 10^5

D 9×10^{-5}

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: $t_{½}$ goes Up-Flat-Down with $[A]_0$'.

Correct Answer A 9 × 10^5

CONCEPT

Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

↓

LOGIC / WORKING

- Apply the key idea: Units of k: (mol L^{-1})^(1−n) s^{-1}. $t_{½} \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.
- Check each option against it — only (A) is consistent: 9 × 10^5

FINAL: (A) 9 × 10^5

SHORTCUT / EXAM TRICK

Units of k: (mol L^{-1})^(1−n) s^{-1}. $t_{½} \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.

COMMON MISTAKE

Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in $t_{½}$ problems (0.693 = ln 2, 2.303 = ln 10).

EXAM TIP

If $t_{½}$ halves when $[A]_0$ doubles → second order; if $t_{½}$ doubles → zero order; unchanged → first order.

MEMORY TRICK

'Zero-First-Second: $t_{½}$ goes Up-Flat-Down with $[A]_0$'.

Why the Other Options Are Wrong

Correct answer: A

B 10^{-5}

Why (A) is the key — Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

C 10^{5}

Ruled out: Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

D 9×10^{-5}

Ruled out: If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

Q74

For the parallel first order reaction shown below the value of k_1 is $1 \times 10^{-4}\ s^{-1}$. If the reaction starts from X, the ratio of the concentrations of Y and Z at any given time during the course of the reaction is found to be ([Y])/([Z]) = (1)/(4). The value of k_2 is:

A $1 \times 10^{-4}\ s^{-1}$

B $2.5 \times 10^{-5}\ s^{-1}$

C $4 \times 10^{-4}\ s^{-1}$

D $4 \times 10^{4}\ s^{-1}$

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Correct Answer C $4 \times 10^{-4}\ s^{-1}$

CONCEPT

Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

↓

LOGIC / WORKING

- Apply the key idea: Units of k: (mol L^{-1})^(1−n) s^{-1}. $t_{½} \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.
- Check each option against it — only (C) is consistent: $4 \times 10^{-4}\ s^{-1}$

FINAL: (C) $4 \times 10^{-4}\ s^{-1}$

SHORTCUT / EXAM TRICK

Units of k: (mol L^{-1})^(1−n) s^{-1}. $t_{½} \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.

COMMON MISTAKE

Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in $t_{½}$ problems (0.693 = ln 2, 2.303 = ln 10).

EXAM TIP

If $t_{½}$ halves when $[A]_0$ doubles → second order; if $t_{½}$ doubles → zero order; unchanged → first order.

MEMORY TRICK

'Zero-First-Second: $t_{½}$ goes Up-Flat-Down with $[A]_0$'.

Why the Other Options Are Wrong

Correct answer: C

A $1 \times 10^{-4}\ s^{-1}$

Why (C) is the key — Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

B $2.5 \times 10^{-5}\ s^{-1}$

Ruled out: Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

D $4 \times 10^{4}\ s^{-1}$

Ruled out: If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

Q75 The specific rate constant of decomposition of compound is represented by ln k = 5.0 - (12000)/(T) The activation energy of decomposition for this compound at 300 K is

A. 24 kcal/mole

B. 12 kcal/mole

C. 24 cal/mole

D. 12 cal/mole

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Correct Answer C 24 cal/mole

CONCEPT

Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

↓

LOGIC / WORKING

- Apply the key idea: Units of k: (mol L^{-1})^(1−n) s^{-1}. $t½ \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.
- Check each option against it — only (C) is consistent: 24 cal/mole

FINAL: (C) 24 cal/mole

SHORTCUT / EXAM TRICK

Units of k: (mol L^{-1})^(1−n) s^{-1}. $t½ \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.

COMMON MISTAKE

Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

EXAM TIP

If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

MEMORY TRICK

'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Why the Other Options Are Wrong

Correct answer: C

A **24 kcal/mole**

Why (C) is the key — Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

B **12 kcal/mole**

Ruled out: Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

D **12 cal/mole**

Ruled out: If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

Q76

For a given first order reaction, the reactant reduces to 1/4^th its initial value in 10 minutes. The rate constant of the reaction is:

A. 0.1386 min^{-1}

B. 0.0693 min^{-1}

C. 0.1386 mol L^{-1} min^{-1}

D. 0.0693 mol L^{-1} min^{-1}

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Correct Answer A 0.1386 min⁻¹

CONCEPT

Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

↓

LOGIC / WORKING

- Apply the key idea: Units of k: (mol L⁻¹)^(1−n) s⁻¹. t½ ∝ $[A]_0$^(1−n): independent of $[A]_0$ only for first order.
- Check each option against it — only (A) is consistent: 0.1386 min⁻¹

FINAL: (A) 0.1386 min⁻¹

SHORTCUT / EXAM TRICK

Units of k: (mol L⁻¹)^(1−n) s⁻¹. t½ ∝ $[A]_0$^(1−n): independent of $[A]_0$ only for first order.

COMMON MISTAKE

Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

EXAM TIP

If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

MEMORY TRICK

'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Why the Other Options Are Wrong

Correct answer: A

B **0.0693 min⁻¹**

Why (A) is the key — Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

C **0.1386 mol L⁻¹ min⁻¹**

Ruled out: Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

D **0.0693 mol L⁻¹ min⁻¹**

Ruled out: If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

Q77

For a reaction involving two steps given below First step: G ⇌ 2H Second step: G + H → P assume that the first step attains equilibrium rapidly. The rate of formation of P is proportional to

A. $[G]^{1}/2$

B. $[G]$

C. $[G]^{2}$

D. $[G]^{3}/2$

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Correct Answer D [G]³/2

CONCEPT

Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

↓

LOGIC / WORKING

- Apply the key idea: Units of k: (mol L^{-1})^(1−n) s^{-1}. $t_{½} \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.
- Check each option against it — only (D) is consistent: [G]³/2

FINAL: (D) [G]³/2

SHORTCUT / EXAM TRICK

Units of k: (mol L^{-1})^(1−n) s^{-1}. $t_{½} \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.

COMMON MISTAKE

Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in $t_{½}$ problems (0.693 = ln 2, 2.303 = ln 10).

EXAM TIP

If $t_{½}$ halves when $[A]_0$ doubles → second order; if $t_{½}$ doubles → zero order; unchanged → first order.

MEMORY TRICK

'Zero-First-Second: $t_{½}$ goes Up-Flat-Down with $[A]_0$'.

Why the Other Options Are Wrong

Correct answer: D

A **$[G]^{1}/2$**

Why (D) is the key — Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

B **[G]**

Ruled out: Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

C **$[G]^2$**

Ruled out: If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

Q78 The rate constant of a reaction is 1.25×10^{-4} mol L^{-1} s^{-1}. If the initial concentration of the reactant is 0.250 mol L^{-1}, the total time (in second) required for complete conversion is ___
(Numerical answer type — write the value.)

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Q79 The dependence of rate constant k on a temperature T (in K) of a reaction is given by the expression ln k = [(-5000 K)/T] + 10 The activation energy of the reaction (in kJ mol^{-1}) is ___ (up to two decimal places) (Numerical answer type — write the value.)

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Q80

Under physiological conditions, the conversion of CO_2 to bicarbonate ion by carbonic anhydrase enzyme (MW = 30,000 g mol^{-1}) has a turnover number of 4.00×10^5 s^{-1}. The minimum amount of enzyme (in mug) required to convert 0.44 g of CO_2 to bicarbonate ions in 100 seconds is _____ (up to two decimal places)
(Numerical answer type — write the value.)

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Q81

According to Eyring state theory for a bimolecular reaction, the activated complex has

A. no vibrational degrees of freedom

B. vibrational degrees of freedom but they never participate in product formation

C. one high frequency vibration that leads to product formation

D. one low frequency vibration that leads to prodcut formation

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'Zero-First-Second: $t_{½}$ goes Up-Flat-Down with $[A]_0$'.

Correct Answer C one high frequency vibration that leads to product formation

CONCEPT

Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

↓

LOGIC / WORKING

- Apply the key idea: Units of k: (mol L^{-1})^(1−n) s^{-1}. $t_{½} \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.
- Check each option against it — only (C) is consistent: one high frequency vibration that leads to product formation

FINAL: (C) one high frequency vibration that leads to product formation

SHORTCUT / EXAM TRICK

Units of k: (mol L^{-1})^(1−n) s^{-1}. $t_{½} \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.

COMMON MISTAKE

Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in $t_{½}$ problems (0.693 = ln 2, 2.303 = ln 10).

EXAM TIP

If $t_{½}$ halves when $[A]_0$ doubles → second order; if $t_{½}$ doubles → zero order; unchanged → first order.

MEMORY TRICK

'Zero-First-Second: $t_{½}$ goes Up-Flat-Down with $[A]_0$'.

Why the Other Options Are Wrong

Correct answer: C

A **no vibrational degrees of freedom**

Why (C) is the key — Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

B **vibrational degrees of freedom but they never participate in product formation**

Ruled out: Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

D **one low frequency vibration that leads to prodcut formation**

Ruled out: If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

Q82

Consider the following two parallel irreversible first order reactions at temperature T, where k_1 and k_2 are the rate constants and their values are 5×10^{-2} and 15×10^{-2} min^{-1} respectively, at temperature T. If the initial concentration of the reactant 'P' is 4 mol L^{-1}, then the concentration of product 'R' after 10 min of reaction is ___ mol L^{-1}. (Round off to two decimal places) (Assume only P is present at the beginning of the reaction)
(Numerical answer type — write the value.)

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: $t_{½}$ goes Up-Flat-Down with $[A]_0$'.

Q83

For an enzyme catalyzed reaction, the plot of inverse of initial rate against inverse of initial substrate concentration is linear with slope 0.16 s and intercept 2.12 mol^{-1} L s. The estimated value of Michaelis constant (in mol L^{-1}, rounded off to two decimal places) is ___
(Numerical answer type — write the value.)

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: $t_{½}$ goes Up-Flat-Down with $[A]_0$'.

Q84

In a reaction, reactant X is converted to products Y and Z consecutively with rate constants 6.0×10^{-2} min^{-1} and 9.0×10^{-3} min^{-1}, respectively. If the initial amount of X is 12.5 moles, the number of moles (rounded off to one decimal place) of Y formed after 10 minutes is ___
(Numerical answer type — write the value.)

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

Q85

For the ring opening reaction of cyclopropane to propene at 25°C, the pre-exponential factor is 4.3×10^{15} s^{-1}. The entropy of activation (in J K^{-1} mol^{-1}, rounded off to two decimal places) is ____ (Given: h = 6.626×10^{-34} J s; $k_B = 1.38 \times 10^{-23}$ J K^{-1}; R = 8.314 J K^{-1} mol^{-1})
(Numerical answer type — write the value.)

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Q86

The rate constants for the decomposition of a molecule in the presence of oxygen are 0.237 × 10⁻⁴ L mol⁻¹ s⁻¹ at 0°C and 2.64 × 10⁻⁴ L mol⁻¹ s⁻¹ at 25°C (R = 8.314 J mol⁻¹ K⁻¹). The activation energy for this reaction (rounded off to one decimal place) is _____ kJ mol⁻¹. 1. (c) 2. (b) 3. (c) 4. (c) 8. (c) 9. (c) 10. (c) 11. (b) 15.

A 16

B 17

C 18. (c) 22. (c) 23

D 24. (d) 25. (a) 29. (d) 30. (a) 31. (c) 32. (c) 36. (5) 37. (6.6) 38. (100) 39. (2000) 42. (7.5) 43. (c) 44. (289.6 sec) 45. (b)

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Q87

A reaction follows second order rate law, $-d[A]/dt = k[A]^2$, if

A. a plot of [A] versus it is a straight line

B. a plot of 1/[A] versus t is a straight line

C. a plot of ln [A] versus t is a straight line

D. a plot of e^[A] versus t is a straight line

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Correct Answer C a plot of ln [A] versus t is a straight line

CONCEPT

Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

↓

LOGIC / WORKING

- Apply the key idea: Units of k: (mol L^{-1})^(1−n) s^{-1}. $t½ \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.
- Check each option against it — only (C) is consistent: a plot of ln [A] versus t is a straight line

FINAL: (C) a plot of ln [A] versus t is a straight line

SHORTCUT / EXAM TRICK

Units of k: (mol L^{-1})^(1−n) s^{-1}. $t½ \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.

COMMON MISTAKE

Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

EXAM TIP

If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

MEMORY TRICK

'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Why the Other Options Are Wrong

Correct answer: C

A **a plot of [A] versus it is a straight line**

Why (C) is the key — Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

B **a plot of 1/[A] versus t is a straight line**

Ruled out: Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

D **a plot of e^[A] versus t is a straight line**

Ruled out: If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

Q88

For the reaction, mathrmQ + R undersetk₋₁stackrelk₁⇌ X xrightarrowk₂ P $k_1 = 2.5 \times 10^5$ L mol^{-1} s^{-1}, $k_{-1} = 1.0 \times 10^4$ s^{-1} and $k_2 = 10$ s^{-1}. Under steady state approximation, the rate constant for the overall reaction in L mol^{-1} s^{-1} (rounded off to the nearest integer) is ___.
(Numerical answer type — write the value.)

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

Q89

The intensity of a monochromatic visible light is reduced by 90% due to absorption on passing through a 5.0 mM solution of a compound. If the path length is 4 cm, then the molar extinction coefficient of the compound in $M^{-1}\ cm^{-1}$ is ___ (Numerical answer type — write the value.)

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Q90 Elemental analysis of an organic compound contaming C, H and O gives percentage composition: C : 39.9% and H : 6.7%. If the molecular weight of the compound is 180, the number of carbon atoms present in the molecule is ___.
(Numerical answer type — write the value.)

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

Q91

A 2.5×10^{-4} M solution of a complex exhibits an absorption maximum at 625 nm with an absorbance of 0.90 when measured in a cuvette with a path length of 1.5 cm. The absorbance of 1.5×10^{-3} M solution of the same complex recorded in a cuvette with a path length of 0.2 cm is ___.
(Numerical answer type — write the value.)

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: $t_{½}$ goes Up-Flat-Down with $[A]_0$'.

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

Q92

For a particular reaction at constant temperature, a plot of inverse of reactant concentration ((1)/([A])) versus time is a straight line with a slope of 4.0×10^{-2} L mol^{-1} s^{-1}. The time required (in seconds) for 1.0 M of reactant to decrease to 0.25 M is:

A 18.8

B 34.7

C 75.0

D 187.5

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: $t_{½}$ goes Up-Flat-Down with $[A]_0$'.

Q93

The percent transmittance of a solution having absorbance (optical density) 1.0 is

A 1

B 10

C 50

D 99

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'Zero-First-Second: $t_{½}$ goes Up-Flat-Down with $[A]_0$'.

Correct Answer B 10

CONCEPT

Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

↓

LOGIC / WORKING

- Apply the key idea: Units of k: (mol L^{-1})^(1−n) s^{-1}. $t½ \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.
- Check each option against it — only (B) is consistent: 10

FINAL: (B) 10

SHORTCUT / EXAM TRICK

Units of k: (mol L^{-1})^(1−n) s^{-1}. $t½ \propto [A]_0$^(1−n): independent of $[A]_0$ only for first order.

COMMON MISTAKE

Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

EXAM TIP

If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

MEMORY TRICK

'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Why the Other Options Are Wrong

Correct answer: B

A **1**

Why (B) is the key — Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

C **50**

Ruled out: Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in t½ problems (0.693 = ln 2, 2.303 = ln 10).

D **99**

Ruled out: If t½ halves when $[A]_0$ doubles → second order; if t½ doubles → zero order; unchanged → first order.

Q94 For a reaction with rate equation $-dC/dt = kC^2$, C_0 and C are the concentrations of the reactant at time 0 and t respectively. If 10 minutes were required for C_0 to become $C_0/2$, the time required for C_0 to become $C_0/4$ is:

A. 10 min

B. 20 min

C. 30 min

D. 40 min

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

Q95

From the reaction aA → products, the plot of (1)/([A]) versus time (t) gives a straight line. Order of the reaction is

A. 0

B. 1

C. 2

D. 3

SELF-PRACTICE official answer key not printed in the source — attempt this, then verify.

QUESTION INSIGHTS

ESTIMATED TIME
3–5 min

DIFFICULTY
Hard

CONCEPT TESTED
Chemical Kinetics – General

PYQ FREQUENCY
Very High · 11 paper

REVISION PRIORITY
★★★★★

EXPECTED LEVEL
Part C (high merit)

MEMORY HOOK
'Zero-First-Second: t½ goes Up-Flat-Down with $[A]_0$'.

TOPIC REVISION

Chemical Kinetics – General

61 PYQs · Last-minute revision

TOPIC SUMMARY

Rate = −(1/a)d[A]/dt; order comes only from experiment, molecularity from the elementary step. Integrated laws: zero → $[A]=[A]_0-kt$, first → $\ln[A]=\ln[A]_0-kt$, second → $1/[A]=1/[A]_0+kt$.

IMPORTANT FORMULA SHEET

- $t_{½}(1st) = 0.693/k$
- $t_{½}(2nd) = 1/(k[A]_0)$
- $t_{½}(0th) = [A]_0/2k$
- k = A e^(−Ea/RT)
- $\ln(k_2/k_1) = (Ea/R)(1/T_1 - 1/T_2)$

FREQUENTLY ASKED CONCEPTS

- Order vs molecularity
- Half-life dependence on $[A]_0$
- Units of k by order
- Pseudo-first-order conditions
- Steady-state vs pre-equilibrium

COMMON MISTAKES & QUICK NOTES

Watch out:
Reading order from stoichiometric coefficients; mixing $\log_{10}$ and ln in $t_{½}$ problems (0.693 = ln 2, 2.303 = ln 10).
If $t_{½}$ halves when $[A]_0$ doubles → second order; if $t_{½}$ doubles → zero order; unchanged → first order.

MOST-REPEATED PYQs & EXPECTED IN EXAM

PYQs in this topic: Q35 Q36 Q37 Q38 Q39 Q40 Q41 Q42 Q43 Q44 Q45 Q46 Q47 Q48 …

Expect 6 question(s) next session on Chemical Kinetics – General.

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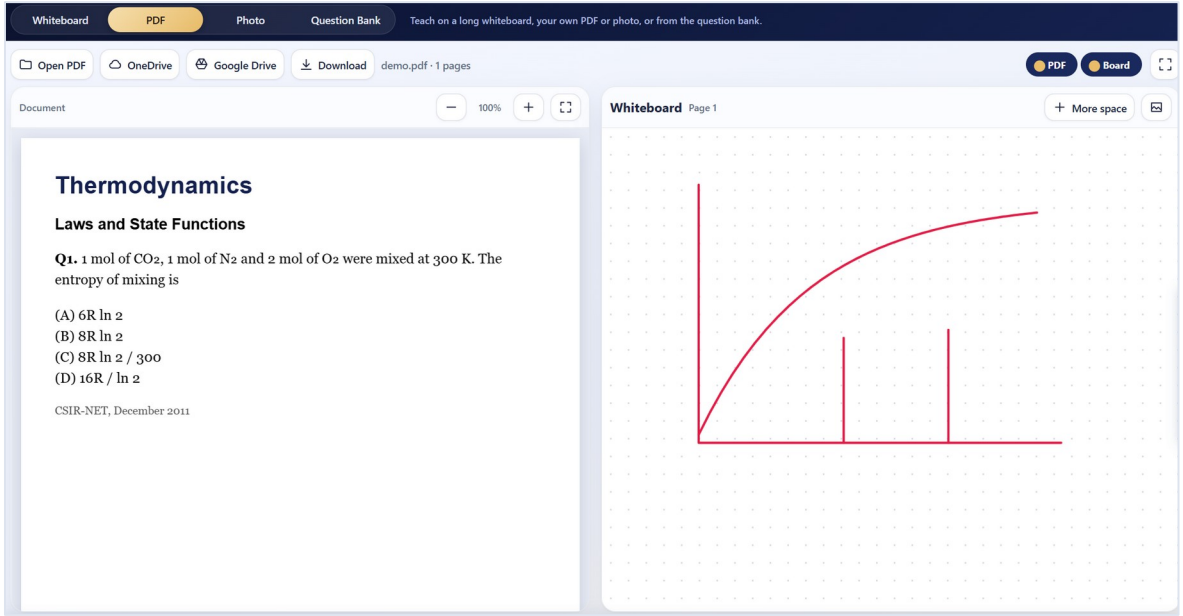
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